

## CLAIMS

What is Claimed is:

1. An optical functional device comprising:
  - 5 two optical waveguides having mutually different equivalent refractive indices; and
  - a connection through which the two optical waveguides are connected along an optical axis.
- 10 2. An optical functional device comprising:
  - a first optical waveguide;
  - a second optical waveguide having an equivalent refractive index lower than that of the first optical waveguide; and
  - a connection through which the first and second optical waveguides are connected along an optical axis and which functions as a multimode interference waveguide.
- 15 3. The optical functional device according to Claim 2,
  - wherein the connection allows multimode propagation of a light passing through the second optical waveguide, and allows the light to be coupled into the first optical waveguide.
- 20 4. The optical functional device according to Claim 2,
  - wherein the first optical waveguide allows single mode propagation of a light passing therethrough.
- 25 5. The optical functional device according to Claim 1,

wherein the equivalent refractive index of the connection is changed in succession or in steps along the optical axis.

6. The optical functional device according to Claim 1,

5 wherein the equivalent refractive index of the connection is changed in succession or in steps along a direction approximately perpendicular to the optical axis.

7. The optical functional device according to Claim 1,

10 wherein the optical functional device has at least one of the functions of an optical isolator, an optical circulator and a mode converter.

8. An optical functional device comprising:

two optical waveguides having mutually different refractive indices; and  
a connection through which the two optical waveguides are connected,

15 wherein single mode propagation of a light incident on one of the optical waveguides, having a high refractive index, is allowed through the one of the optical waveguides, and

20 wherein multimode propagation of a light incident on the other optical waveguide having a low refractive index is allowed through the other optical waveguide and the connection, thus realizing optical nonreciprocity..

9. The optical functional device according to Claim 8,

wherein the optical functional device has at least one of the functions of an optical isolator, an optical circulator and a mode converter.

10. An optical functional device comprising:
- a first optical waveguide;
  - a second optical waveguide having an equivalent refractive index lower than that of the first optical waveguide; and
- 5        a connection through which the first and second optical waveguides are connected along an optical axis,
- wherein the connection is formed by selectively enlarging the waveguide width of the second optical waveguide.
- 10        11. The optical functional device according to Claim 10,
- wherein the first and second optical waveguides are each provided as a planar lightwave circuit, and
- wherein the first and second optical waveguides are horizontally arranged.
- 15        12. The optical functional device according to Claim 10,
- wherein the first and second optical waveguides are each provided as a planar lightwave circuit, and
- wherein the second optical waveguide is located over the first optical waveguide, or the first optical waveguide is located over the second optical waveguide.
- 20        13. The optical functional device according to Claim 10,
- wherein the first and second optical waveguides each include a core and cladding, and
- wherein a difference between the equivalent refractive index of the first optical waveguide and that of the second optical waveguide is determined by the cladding.

14. The optical functional device according to Claim 13,

wherein the cladding of the first optical waveguide and that of the second optical waveguide are made of the same material, and

5 wherein the difference between the equivalent refractive indices is determined by a difference between the thickness of the cladding of the first optical waveguide and that of the cladding of the second optical waveguide.

15. The optical functional device according to Claim 10,

10 wherein the optical functional device has at least one of the functions of an optical isolator, an optical circulator and a mode converter.

16. An optical module comprising: an optical functional device functioning as at least one of an optical isolator and an optical circulator; a laser element; and a light-receiving element,

20 wherein the optical functional device comprises:  
two optical waveguides having mutually different equivalent refractive indices; and  
a connection through which the two optical waveguides are connected along an optical axis.

25 17. An optical module comprising: an optical functional device functioning as at least one of an optical isolator and an optical circulator; a laser element; and a light-receiving element,

wherein the optical functional device comprises:

two optical waveguides having mutually different refractive indices; and

a connection through which the two optical waveguides are connected,  
wherein single mode propagation of a light incident on one of the optical  
waveguides, having a high refractive index, is allowed through the one of the optical  
waveguides, and  
5        wherein multimode propagation of a light incident on the other optical waveguide  
having a low refractive index is allowed through the other optical waveguide and the  
connection, thus realizing optical nonreciprocity.

18. An optical module comprising: an optical functional device functioning as at  
10 least one of an optical isolator and an optical circulator; a laser element; and a light-  
receiving element,

wherein the optical functional device comprises:  
a first optical waveguide;  
a second optical waveguide having an equivalent refractive index lower than that of  
15 the first optical waveguide; and  
a connection through which the first and second optical waveguides are connected  
along an optical axis, and  
wherein the connection is formed by selectively enlarging the waveguide width of  
the second optical waveguide.